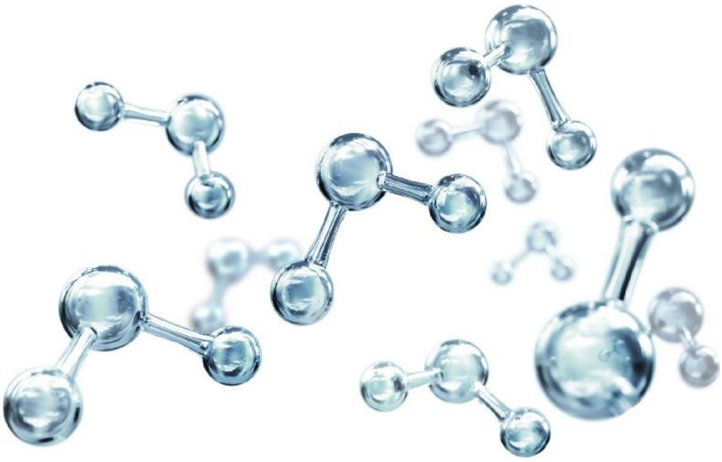
Seminar

Centre for Molecular Water Science

13th of January 2022
12:00 h

Zoom Virtual Meeting:
https://desy.zoom.us/j/84703564086
Meeting-ID: 847 0356 4086
Password: 570173



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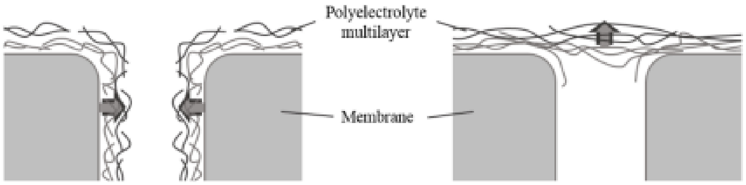
Expanding removal potentials of porous polymer membranes for sustainable drinking water treatment

Porous polymer membranes like microfilters or ultrafilters are an attractive option for water treatment. On the one hand, they provide a complete barrier against pathogens (disinfection). On the other hand they can be operated at moderate pressures, in dead-end mode and at high water fluxes resulting in relatively low specific energy demands (<0,4 kWh/m^3). Commonly applied porous polymer materials are polyether-sulfone (PES), polyacrylonitrile (PAN) or polyamide (PA). Their production costs dropped extensively within the last 20 years due to economy of scale and material optimisation. The presentation will focus on different modification approaches to expand the removal potentials of porous membranes into the range of dissolved water constituents for selective removal. As a first example: UF-PES membranes can be easily coated by layer-by-layer (LbL) technology using polyanions and polycations to narrow the pore size stepwise to desired molecular weight cut-offs (MWCO). Next to this stepwise shifting of UF into low pressure reverse osmosis range another important advantage is that the backwash-ability will persist, offering new ways of fouling control. As a second example, the chemical post-treatment of UF-PAN membranes by amine functionalities was conducted in cooperation with Helmholtz-Zentrum Hereon. The success of the chemical modification was demonstrated by high loading rates for oxy-anions (As(V), Cr(VI)), infrared spectroscopy and zeta potential (ZP) data. These membranes are capable to remove highly toxic ions in dead-end filtration and can be regenerated within the backwash cycle by salt solutions. A final example is the modification of porous polymer materials by metal (Au, Pt) coating. By choosing the right material properties (ZP, BET, conductivity) such material can be activated as selective filters for natural organic matter or hazardous trace organics by an electrostatic potential supplied to the active side. The loaded material such as Au-duplex coated MF-PA can be regenerated by simply switching the surface potential during backwash.



Polyelectrolyte layer-by-layer coating of membrane pores for drinking water treatment